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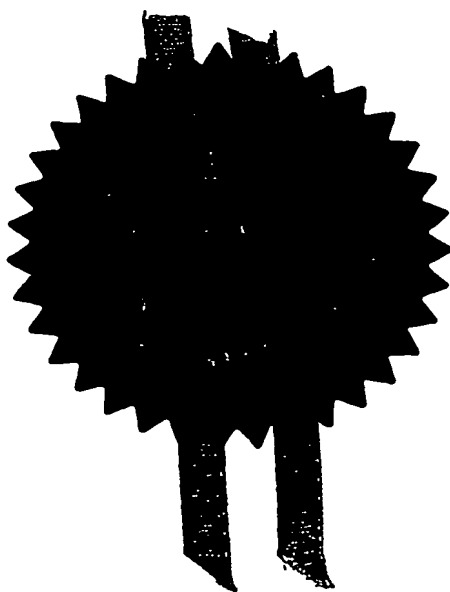
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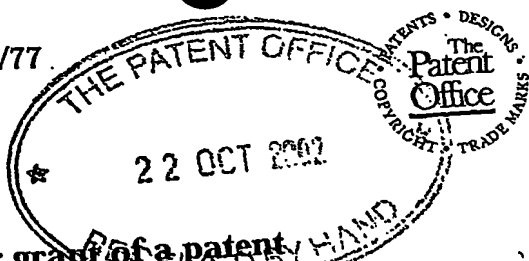
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1. Your reference

HL81815/CLF

2. Patent application number  
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22 OCT 2007

0224581.9

3. Full name, address and postcode of the or of each applicant (underline all surnames)

PANDROL LIMITED  
63 Station Road  
Addlestone  
Surrey KT15 2AR  
United Kingdom

07310097001  
Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO SLEEPER

5. Name of your agent (if you have one)

Haseltine Lake

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Imperial House  
15-19 Kingsway  
London  
WC2B 6UD

Patents ADP number (if you know it)

34001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
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Description 7

Claim(s) 4

Abstract 1 DM

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) 1 ✓

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11.

I/We request the grant of a patent on the basis of this application.

Haseltine Lake, Agents for the Applicants

Signature

Haseltine Lake

Date

22 October 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Christine Fenlon

[020] 7420 0500

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METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO  
SLEEPER

5       The present invention relates to a method of  
attaching a rail clip anchoring device to a sleeper.

At present cast iron rail clip anchoring devices,  
or "shoulders", are attached to rolled steel sleepers  
using separate fasteners, for example bolts and nuts,  
10 or by welding. However, owing to the large number of  
shoulder/sleeper assemblies that are required it is  
desirable in order to reduce costs to fasten the  
shoulder to the sleeper without the additional expense  
of a separate fastening component. For the same reason  
15 it is also desirable to keep machining of either the  
sleeper or the shoulder to a minimum.

According to a first aspect of the present  
invention there is provided a method of attaching a  
steel railway sleeper to a ductile iron rail clip  
20 anchoring device, which method comprises:

inserting a boss, extending from the bottom of a  
body of the anchoring device, into a hole passing  
through the sleeper at a location on its surface at  
which the anchoring device is to be attached until the  
25 anchoring device body abuts the sleeper surface; and

compressing the steel around the hole in a region  
on the sleeper surface opposite to that on which the  
anchoring device body is located, while the anchoring  
device is held in place, so that the compressed steel  
30 flows plastically against the boss within the hole,  
until the force thereby applied to the boss brings  
about elongation thereof, whereby the boss undergoes an  
elastic set which clamps the boss to the sleeper.

This method is quick and simple and has the  
35 additional advantages that (a) there is no requirement

for a separate fastening component, (b) there is no need to induce heat into either component, (c) there is no need to clean rust or scale from either component, and (d) the method can be performed with common metalworking tools. Furthermore, unlike methods which simply hold the shoulder in place, a shoulder and sleeper joined using this method must undergo stress reversal before they can be separated.

Preferably, the boss is provided with at least one recess in its flank and the compressed steel also flows plastically into that recess. Desirably, the recess comprises a single non-helical groove extending around the boss. Alternatively, the flank of the boss may be provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

The step of compressing the steel around the hole is preferably performed by applying a penetrating tool, having a working face of desired shape, to the surface of the sleeper opposite to that on which the anchoring device body is located until the tool has entered the sleeper surface for a desired distance. The penetrating tool may be shaped to allow the said elongation of the boss.

The step of inserting the boss into the hole in the sleeper may be performed by supporting the anchoring device so that the boss extends upwardly and then lowering the sleeper such that the boss passes through the hole.

Typically, the sleeper will be provided with two such holes and the method will be carried out simultaneously with respect to both holes thereby to attach two anchoring devices to the sleeper.

The or each hole may be punched into the steel sleeper.

According to a second aspect of the present invention there is provided a rail clip anchoring  
5 device, for use with a method embodying the first aspect of the present invention, which device has an anchoring device body and, extending from the bottom of that body, a boss provided with at least one recess in its flank.

10 According to a third aspect of the present invention there is provided a railway rail fastening assembly comprising a steel railway sleeper, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device having an  
15 anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the said holes in the sleeper, wherein the boss of each anchoring device has an elastic set whereby the boss is clamped to the sleeper. The boss of at least  
20 one of the anchoring devices may have at least one recess provided in its flank.

As mentioned earlier, the recess preferably comprises a single non-helical groove extending around the boss, but the boss may be provided with a plurality  
25 of recesses, each comprising a non-helical groove extending around the boss.

The profile of the or each groove is preferably substantially that of a buttress thread. 15. The or each recess is preferably provided adjacent a free end  
30 of the boss.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1, 2 and 3 show in perspective respective simplified representations of a shoulder, a portion of a sleeper and a penetrating tool for use in a method embodying the first aspect of the present invention;

5        Figures 4 to 8 illustrate steps in a method embodying the first aspect of the present invention;

Figure 9 shows a typical groove profile used in a shoulder embodying the second aspect of the present invention; and

10        Figures 10 to 12 show views of a sleeper/shoulder assembly produced using a method embodying the first aspect of the present invention.

In a method embodying the first aspect of the present invention a ductile iron rail clip anchoring device, hereafter called a shoulder, is attached to a steel sleeper. A simplified representation of a  
15        shoulder 1 is shown in Figure 1. The shoulder 1 is a ductile iron casting and has a body 10 from which there extends a cylindrical elongate boss 11 provided around  
20        its flank with a plurality of grooves 12 spaced along its length, the first of the grooves 12 being adjacent to the free end 13 of the boss 11. The boss 11 may be of any length less than or equal to the thickness of the sleeper 2 to which the shoulder 1 is to be attached  
25        and can be of any cross-sectional shape, although for ease of manufacture a cylindrical cross-section is preferred.

A simplified representation of a portion of a rolled steel sleeper 2 to which the shoulder 1 of  
30        Figure 1 may be attached is shown in Figure 2, the sleeper 2 having a throughhole 20 of cylindrical cross-section. Each sleeper 2 will have two such holes 20, preferably formed by punching through the sleeper 2, at

locations corresponding to the desired positions of the respective shoulders 1 to be fastened to the sleeper 2. The sleeper 2 has a top face 2a and a bottom face 2b.

In a method embodying the first aspect of the present invention, as shown in Figure 4 firstly two shoulders 1 (only one shown throughout) are held in a fixture jig 4 (not shown in Figure 4) such that their respective bosses 11 extend upwardly. The sleeper 2 is then positioned, with its top face 2a facing downwards, as shown in Figure 5, such that the holes 20 therein slip over the bosses 11 and the top face 2a of the sleeper makes contact with the respective bodies 10 of the shoulders 1. Using a press (not shown), for example a mechanical or hydraulic metal working press of around 200 ton (203.21 tonnes) capacity, a penetrating tool 3 is brought into contact with the bottom face 2b of the sleeper 2, as shown in Figure 6. As shown in Figure 3 the tool 3 is similar to a hollow punch, having a circular working face 30 and a void 31. The working face 30 of the tool 3 is chosen so as to be a little larger in diameter than the hole 20 in the sleeper 2 and in use is brought into contact with the region of the bottom face 2b of the sleeper 2 around the hole 20. As shown in Figure 7 the press forces the tool 3 against the bottom face 2b of the sleeper 2 until the shear strength of the sleeper material is exceeded, whereupon the working face 30 of the tool 3 penetrates the bottom face 2b for a predetermined distance. As a result, steel in the region of the sleeper 2 where the tool 3 has penetrated flows plastically into the grooves 12 and exerts a compressive force against the flank of the boss 11 which acts in such a way that the boss 11 deforms, i.e.



stretches. Since the boss 11 is constrained at one end by the body 10 of the shoulder 1 held in the fixing rig 4, the boss 11 can stretch only upwardly, towards the opening of the hole 20 in the bottom face 2b of the sleeper 2. The void 31 is provided in the tool 3 to allow for this to happen while the tool 3 is being pressed into the sleeper 2. The stretching of the boss 11 results in an elastic set in the boss 11, which remains after the penetrating tool 3 is backed off, and produces a restoring clamping force, similar to that provided by a bolt, which holds the shoulder 1 on the sleeper 2. This stress, acting normal to the sleeper surface 2a, must be overcome (reversed) before any load applied to the shoulder 1 can succeed in lifting the shoulder 1 from the sleeper 2. The assembled shoulder 1 and sleeper 2 are shown in Figures 8, 10 and 11. Retention of the shoulder 1 on the sleeper 2 is assisted by frictional resistance between the boss 11 and the sleeper material in contact with it, and by the steel forced into the grooves 12 in the boss 11 which is in shear at the interface between the boss 11 and the sleeper 2. Although Figure 1 and related Figures show a shoulder 1 having a plurality of grooves 12, a method embodying the first aspect of the invention could usefully employ a boss 11 without any grooves 12 or other recesses, in which case the clamping force between the shoulder 1 and sleeper 2 would not be as great. Preferably, however, a boss 11 having a single, coarser groove may be used instead, as shown in Figure 12, and in fact such an arrangement is likely to be more effective than a plurality of grooves and would be easier to manufacture. Figure 12 shows a section through a sleeper 2, to which a shoulder 1 had been

attached using a method embodying the first aspect of the present invention and has now been removed following cutting of the sleeper 2. An indent 22 left by the action of the penetrating tool 3 on the bottom face 2b of the sleeper 2 can be seen. A groove 12 having a modified buttress thread profile, where the direction of axial loading is opposite in direction to a normal buttress thread, is preferred, as shown in Figure 9. Typical values for the dimensions and angles of the groove 12 shown in Figure 9 are:  $a=6.96\text{mm}$ ,  $b=4.00\text{mm}$ ,  $c=1.70\text{mm}$ ,  $d=1.20\text{mm}$ ,  $e=0.50\text{mm}$ ,  $A=87^\circ$ ,  $B=58^\circ$  and  $C=35^\circ$ .

CLAIMS

1. A method of attaching a steel railway sleeper to a ductile iron rail clip anchoring device, which method  
5 comprises:

inserting a boss, protruding from the bottom of a body of the anchoring device, into a hole passing through the sleeper at a location on its surface at which the anchoring device is to be attached until the  
10 anchoring device body abuts the sleeper surface; and  
compressing the steel around the hole in a region on the sleeper surface opposite to that on which the anchoring device body is located, while the anchoring device is held in place, so that the compressed steel  
15 flows plastically against the boss within the hole, until the force thereby applied to the boss brings about elongation thereof, whereby the boss undergoes an elastic set which clamps the boss to the sleeper.

20 2. A method as claimed in claim 1, wherein the boss is provided with at least one recess in its flank and the compressed steel also flows plastically into the said recess.

25 3. A method as claimed in claim 2, wherein the recess comprises a single non-helical groove extending around the boss.

30 4. A method as claimed in claim 2, wherein the flank of the boss is provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

5. A method as claimed in any preceding claim,  
wherein the step of compressing the steel around the  
hole is performed by applying a penetrating tool,  
having a working face of a desired shape, to the  
5 surface of the sleeper opposite to that on which the  
anchoring device body is located until the tool has  
entered the sleeper surface for a desired distance.
6. A method as claimed in claim 5, wherein the said  
10 penetrating tool is shaped to allow the said elongation  
of the boss.
7. A method as claimed in any preceding claim,  
wherein the step of inserting the boss into the hole in  
15 the sleeper is performed by supporting the anchoring  
device so that the boss extends upwardly and then  
lowering the sleeper such that the boss passes through  
the hole.
- 20 8. A method as claimed in any preceding claim,  
wherein the sleeper is provided with two such holes and  
the method is carried out simultaneously with respect  
to both holes thereby to attach two anchoring devices  
to the sleeper.
- 25 9. A method as claimed in any preceding claim,  
wherein the said hole or holes are punched into the  
steel sleeper.
- 30 10. A method of attaching a steel railway sleeper to a  
ductile iron rail clip anchoring device substantially  
as hereinbefore described with reference to Figures 4  
to 8 of the accompanying drawings.

11. A rail clip anchoring device, for use with the method of any preceding claim, which device has an anchoring device body and, protruding from the bottom of that body, a boss provided with at least one recess in its flank.

12. A device as claimed in claim 11, wherein the recess comprises a single non-helical groove extending around the boss.

13. A device as claimed in claim 11, wherein the flank of the boss is provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

14. A device as claimed in claim 12 or 13, wherein the profile of the or each groove is substantially that of a buttress thread.

15. A device as claimed in any one of claims 11 to 14, wherein the or each recess is provided adjacent a free end of the boss.

16. A rail clip anchoring device substantially as hereinbefore described with reference to Figure 1 or Figure 9 or Figure 12 of the accompanying drawings.

17. A railway rail fastening assembly comprising a steel railway sleeper, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device having an anchoring device body and, protruding from the bottom of that body, a boss which

extends into a respective one of the said holes in the sleeper, wherein the boss of each anchoring device has an elastic set whereby the boss is clamped to the sleeper.

5

18. An assembly as claimed in claim 17, wherein the boss of at least one of the anchoring devices has at least one recess provided in its flank.

10 19. An assembly as claimed in claim 18, wherein the recess comprises a single non-helical groove extending around the boss.

15 20. An assembly as claimed in claim 18, wherein the flank of the boss is provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

20 21. An assembly as claimed in claim 19 or 20, wherein the profile of the or each groove is substantially that of a buttress thread.

25 22. An assembly as claimed in any one of claims 18 to 21, wherein the or each recess is provided adjacent a free end of the boss.

23. A railway rail fastening assembly substantially as hereinbefore described with reference to Figure 8, 10 or 11 of the accompanying drawings.

ABSTRACTMETHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO  
SLEEPER

5           In a method of attaching a steel railway sleeper  
          (2) to a ductile iron rail clip anchoring device (1) a  
          boss (11), extending from the bottom of a body (10) of  
          the anchoring device (1), is inserted into a hole (20)  
          passing through the sleeper (2) at a location on its  
10   surface (2a) at which the anchoring device (1) is to be  
          attached until the anchoring device body (10) abuts the  
          sleeper surface (2a). The steel around the hole (20)  
          in a region on the sleeper surface (2b) opposite to  
          that on which the anchoring device body (10) is located  
15   is compressed while the anchoring device (1) is held in  
          place, so that the compressed steel flows plastically  
          against the boss (11) within the hole (12), until the  
          force applied to the boss (11) brings about elongation  
          thereof, whereby the boss (11) undergoes an elastic set  
20   which clamps the boss (11) to the sleeper (2). The  
          boss (11) may be provided with at least one recess (12)  
          in its flank, such that the compressed steel also flows  
          plastically into the said recess (12). Preferably the  
          recess comprises a single non-helical groove (12)  
25   extending around the boss (11). Alternatively, the  
          boss (11) may be provided with a plurality of recesses,  
          each comprising a non-helical groove (12) extending  
          around the boss (11).

30   [Figure 8]

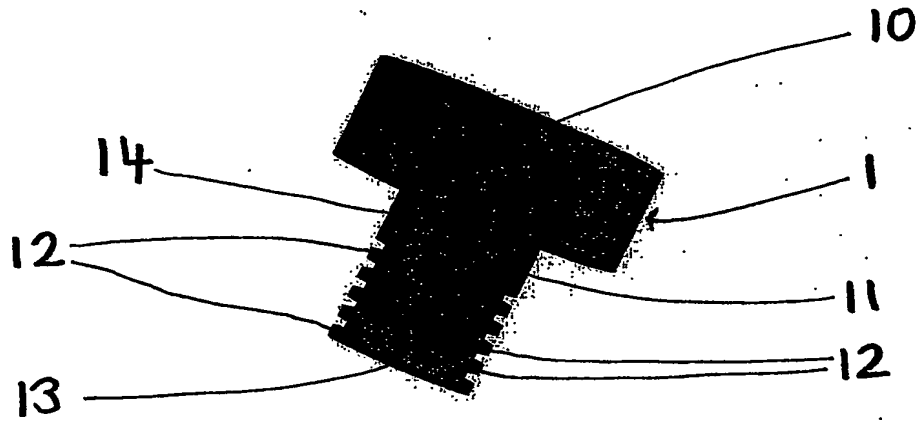


Figure 1

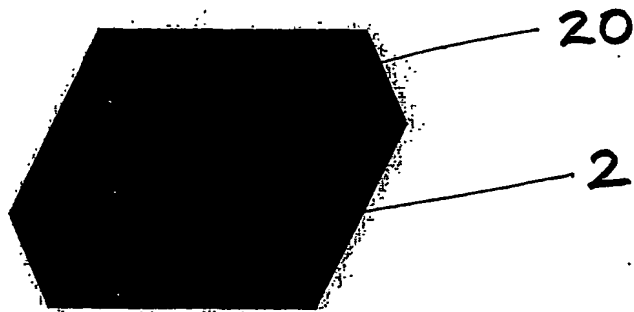


Figure 2

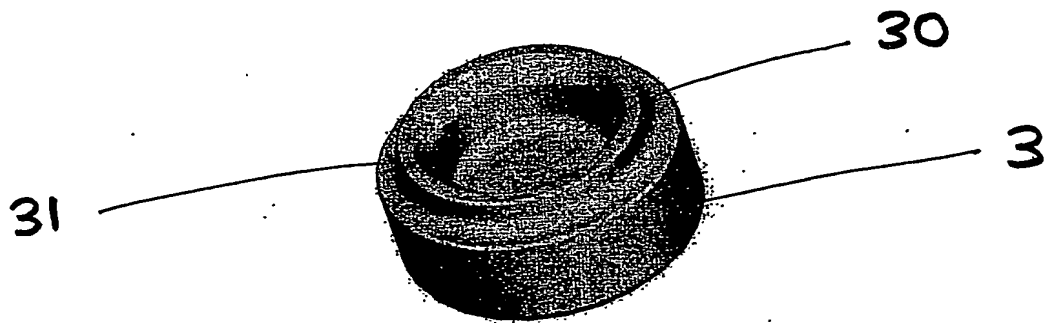


Figure 3



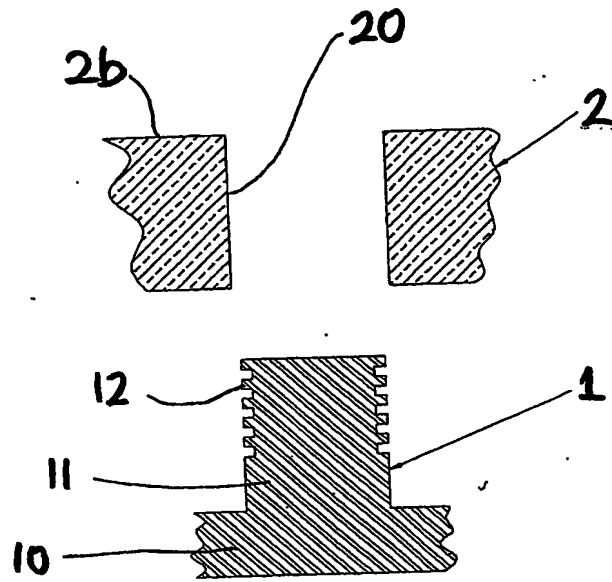


Figure 4

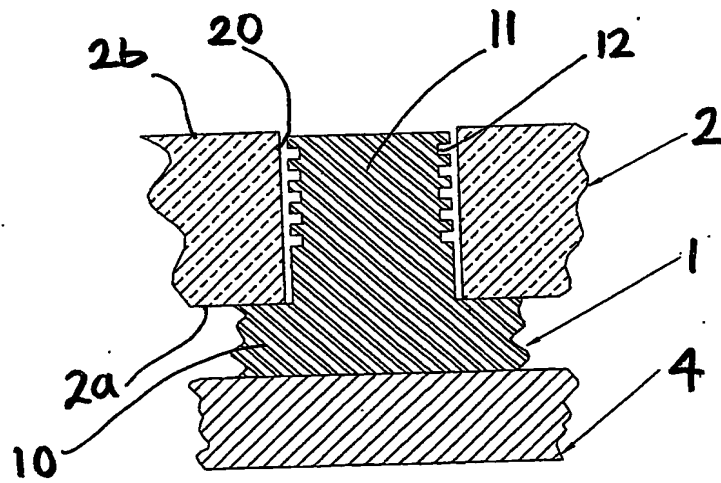


Figure 5

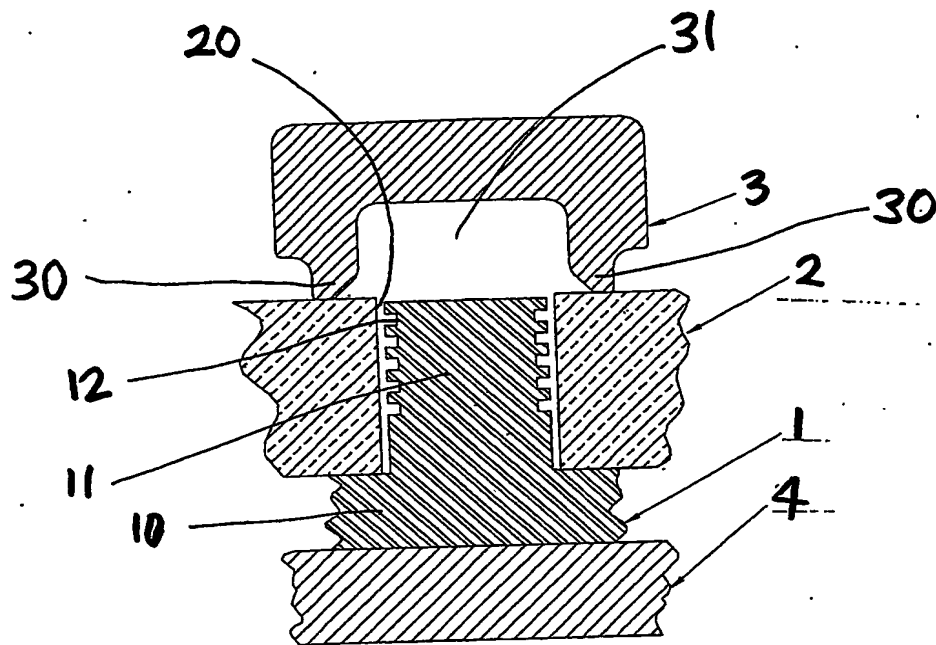


Figure 6

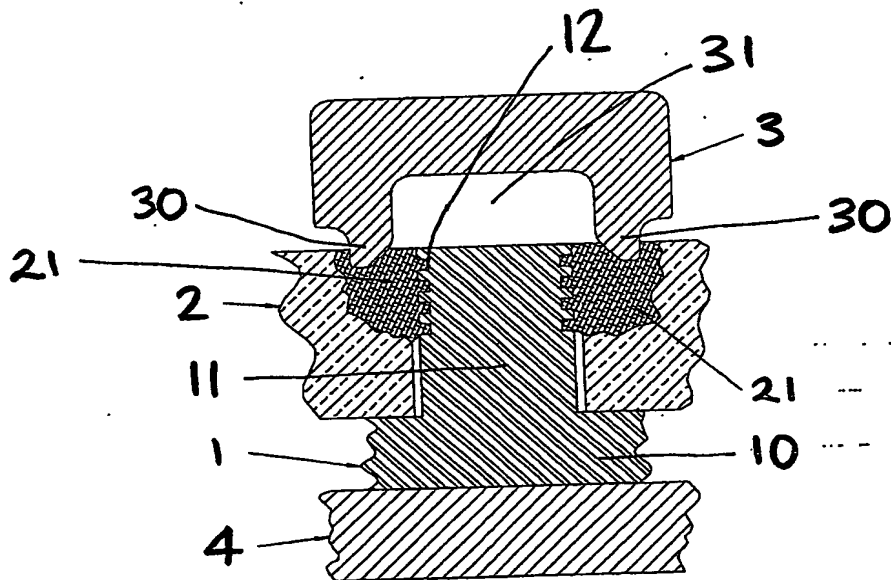


Figure 7

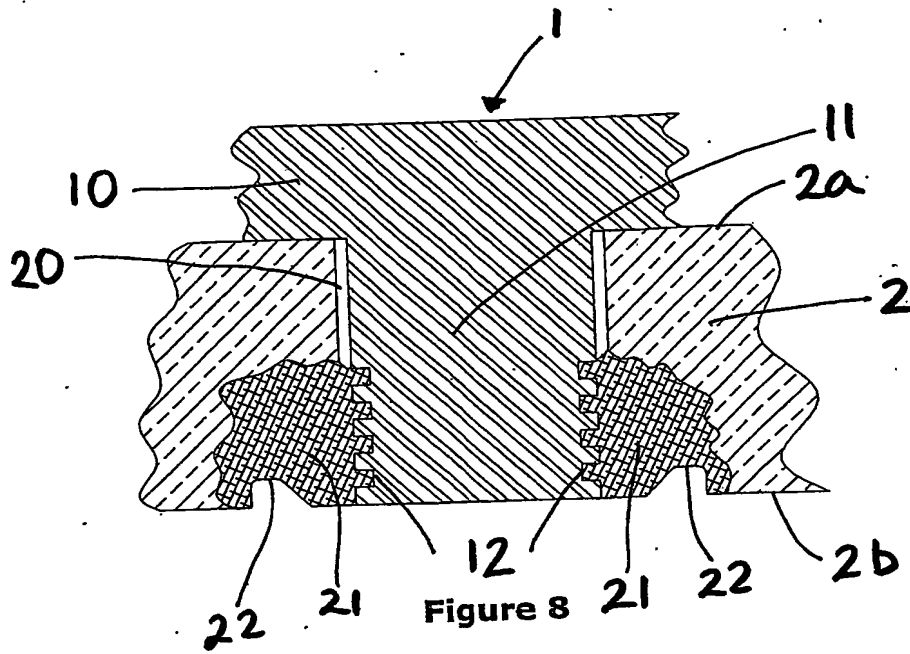
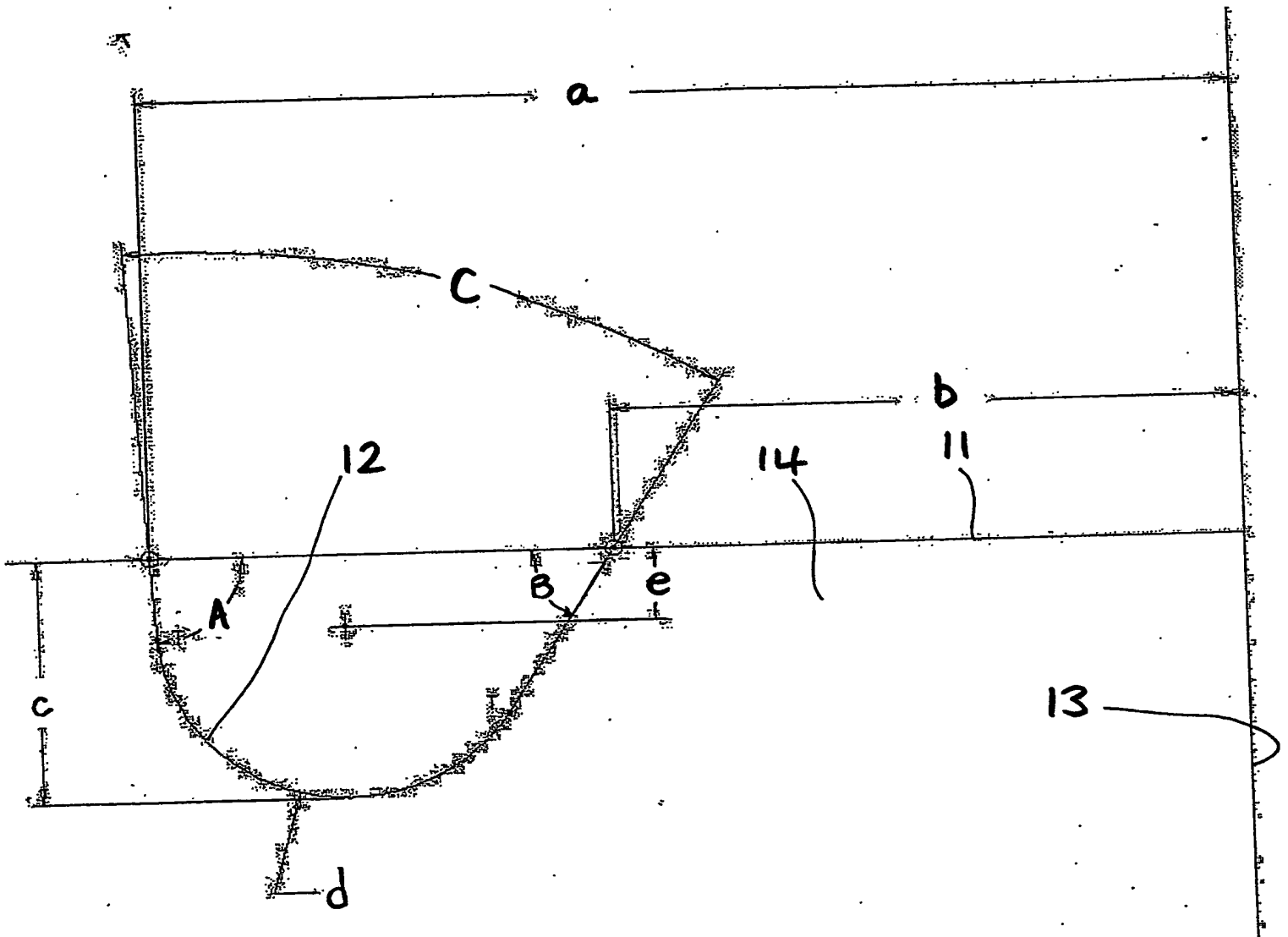
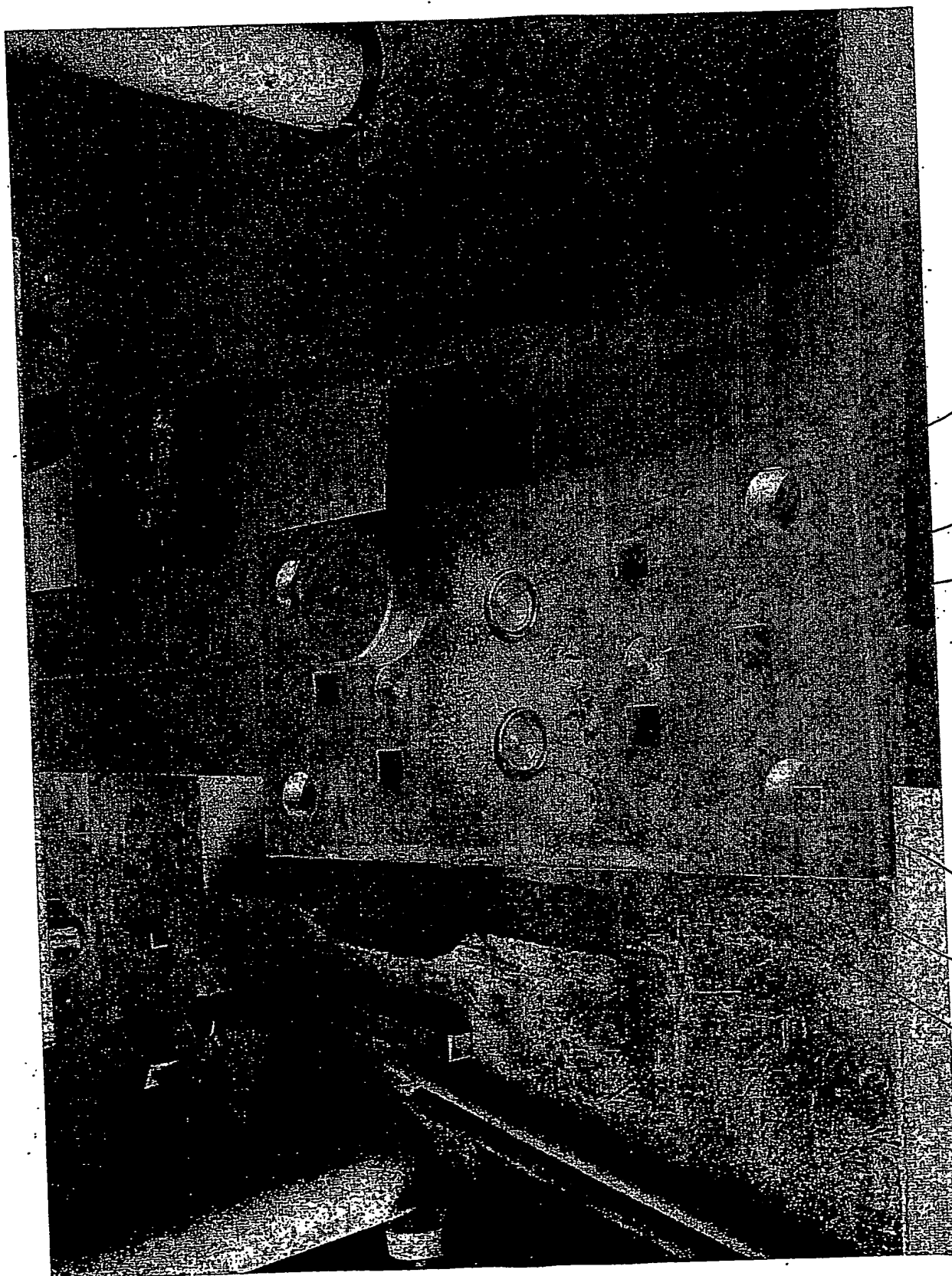


FIG. 9





20

13

2

FIG. 10

2b

13

20

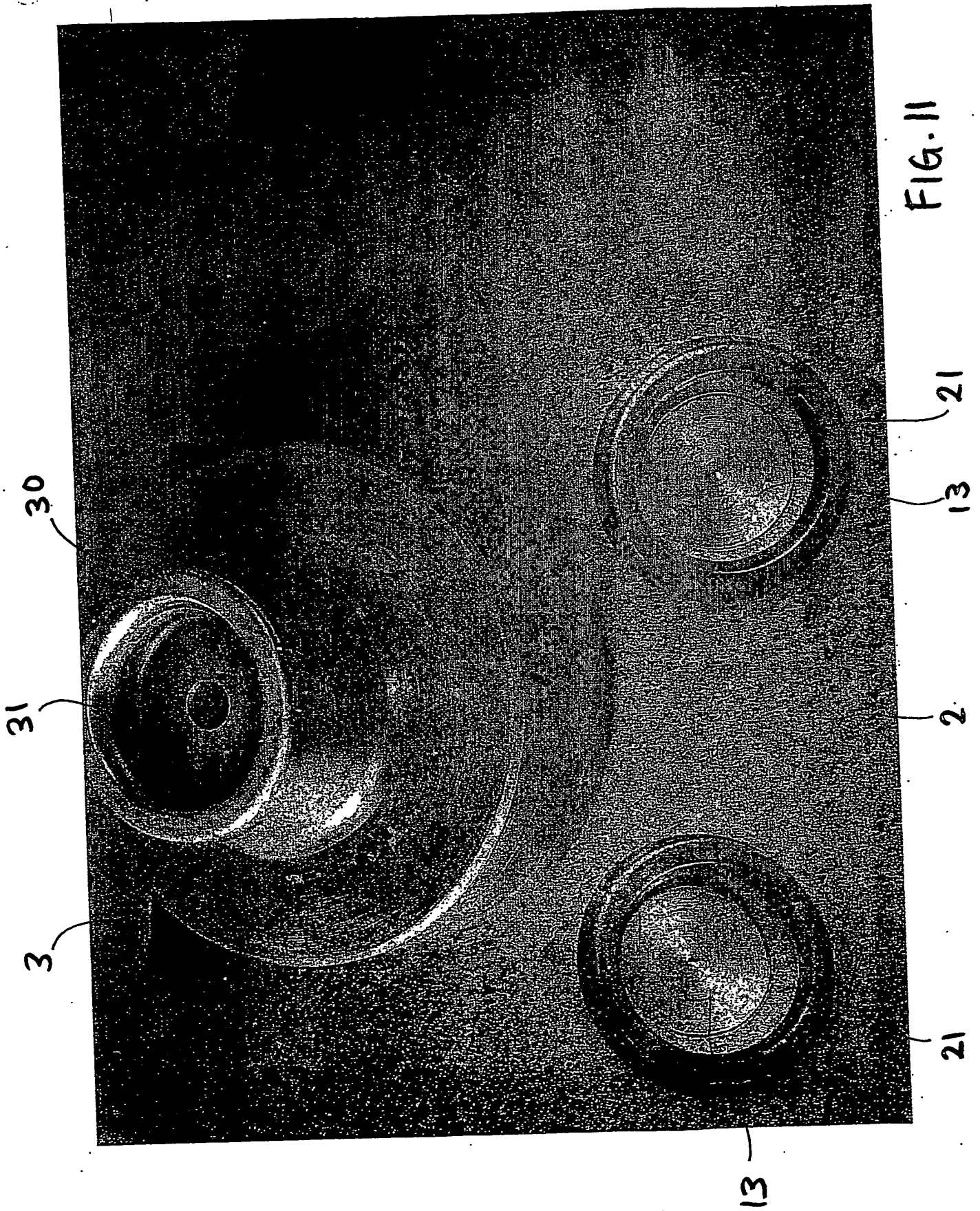


FIG. 11

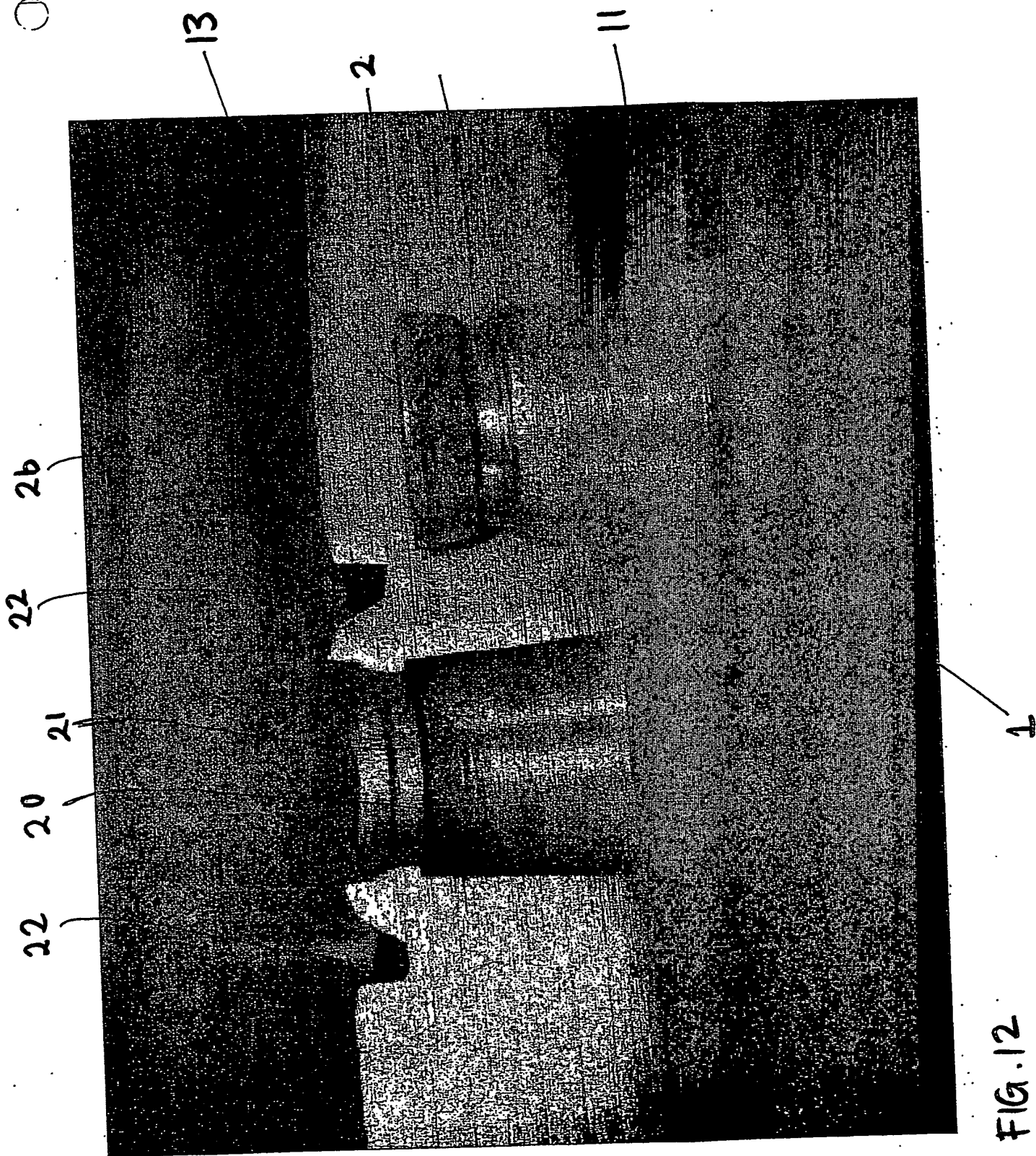


FIG. 12

PCT Application  
**GB0304323**





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